ON THE RELATIONSHIP BETWEEN AGGREGATE MERGER ACTIVITY AND THE STOCK MARKET *

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ABSTRACT

This paper presents substantial evidence to show that the often noted correlation between aggregate merger activity and indices of share prices is unstable, and thus of little predictive value. Further, Granger causality testing suggests that it is not unreasonable to think of such correlations as spurious, reflecting other more fundamental forces which determine movements in both series.

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I. INTRODUCTION

It is fairly widely accepted that corporate merger activity has evolved pari passu with modern capital markets, and the well documented correlation between aggregate merger activity and stock market prices [1] seems an unsurprising outcome of such intertwined development. Quite how to interpret it is less easy to see. It is not very persuasive to argue that it tests a theory about the determinants of mergers[2]; it would be claiming far too much, for example, to assert that it implies the primacy of financial factors over scale economics in explaining mergers. We are on much surer grounds by adopting the more modest view that such a correlation is a simple rule predicting the timing and likely extent of merger booms, and this paper is devoted to exploring how tenable this intepretation is. Section II outlines the reasons why the "correlation as prediction" may be a reasonable rule, and what sort of market behaviour might cause its breakdown; Section III describes the statistical methodology we shall use to explore the issue; Section IV briefly describes a set of rather unexepected results for four rather varied samples; and Section V sums the argument up.

1 See, for example, Nelson, 1959; Hannah, 1974; and Scherer, 1980, Chap. 4. The literature is in general agreement that share prices rather than industrial activity more generally are more closely tied to merger activity (see also Maule, 1968, and the reply by Eis, 1970). "Caveats" can be found in Steiner, 1975, who reports a breakdown in the relationship for the U.S. in the 1970's; and Cable et al, 1980, who find a correlation in West Germany where the stock market apparently plays a fairly unimportant role in merger activity.

2 For a broad survey of merger motives, see Scherer, 1980, Chap. 4, or George and Silberston, 1975; Prais, 1976, discusses mergers much more closely in the context of the operation of financial markets.

II. THE CORRELATION AS PREDICTION

To make the correlation as prediction interpretation tenable requires both empirical verification as well as theoretical explanation of the economic forces at work. The latter is crucial not so much because the correlation "tests" these hypotheses as because the employment of a simple predictive rule requires an understanding of why it works as it does.

Empirical verification is fairly straightforward in principle and requires that questions about structural stability and causality in the sense of Granger (1969) be addressed. Structural stability is an obvious question to pose whenever periodic explosions in times series of interest occur, and is a possibility strongly suggested by previous work in this area [3]. Granger causality is a statement about optimal linear prediction : the statement that "X causes Y" in the sense of Granger applies to a situation where the X series contains some additional information about Y not otherwise in Y's own history, and hence : "X causes Y" if the use of X improves predictions about Y [4]. Questions about structural stability and Granger causality are germane to the reasonableness of the correlation as prediction interpretation, for a non-zero correlation is superflous for predicting purposes unless it is also causal in this sense, and it is obviously not very useful if it is unstable.

[3] Nelson, 1959, discovered that mergers were more highly correlated to share prices in periods of high rather than low merger activity. Inspection of the record for the 1970's suggests structural breaks of perhaps a rather different kind as mergers apparently "failed to respond to" a mild boom in share prices.

[4] Further discussion of this concept can be found in Sims, 1972, 1980; Pierce and Haugh, 1977; Engle et al, 1980; and Jacobs et al, 1979. Since we have ruled out the possibility that this correlation measures the parameters of a structural model, there is no need to pursue here the claims that testing for Granger causality provides information on consistancy in estimation for such a model.

It is one thing to empirically verify that the correlation has or has not got a reasonable predictive interpretation by looking at stability and causality; it is another thing altogether to understand why. We commence by positing two sets of agents, the consequence of whose activity is share price changes and mergers : "investors" who buy and sell shares, and "managers" who make merger decisions. Secondly, it is worth keeping in mind the fact that explaining *aggregate* merger activity and aggregate share price *indices* requires translation of a series of individual decisions by particular agents into collective activity. With these two starting points, we can turn to an explanation of causality and stability.

For an association between share prices and mergers to be causal, it would seem that something in the current or recent past actions of one of the two groups of agents must have an impact on the decision making of members of the other group. That is, if "share prices cause mergers" then something in the activity of investors must alter managers behaviour in a way that could not be predicted solely by looking at the previous behaviour of managers. Since managers behaviour is driven by their expectations about the future stream of profits in the same way that investors behaviour is driven by their expectations about financial returns in the capital market (the two are not necessarily the same; e.g. Schiller, 1981), then it would seem that "share prices cause mergers" if managers' expectations about the gains to merger are affected by the expectations and actions of investors in the markets for shares and bords. The best known example of this kind of argument is Gort's "Economic Disturbance" theory (1969; for some scepticism see the papers in Mueller, 1980), in which share price movements induced by the activity of investors facilitates transactions between pairs of managers involved in a merger, and so stimulates aggregate merger activity. Similarly, managers' actions must somehow affect the expectations of investors regarding share price movements in a way that leads them to depart from previous patterns of behaviour if "mergers cause share prices". Since mergers can generally be expected to increase a firm's market power and so its profits, decisions by managers clearly impinge on the parameters of investors decision making (this line of causation is explored in Lintner, 1971), and that is liable to create the causal chain. To illustrate the explanation, consider the hypothesized course of events in the case where "mergers cause share prices" and "share prices cause mergers". A gentle upswing in merger activity with associated movements in profitability and expected dividends begins to lead to relative share price changes. As such merger activity becomes more widely anticipated by investors, they begin to speculate about likely activity amongst thus far inactive firms, and so induce further share price movements. These, in turn, affect the relative prices of corporate assets and so facilitate even more merger activity.

While a causal association between mergers and share prices can be seen as the result of *cross-group activity*, the explanation of stability is essentially one of *within-group activity*, in a "micromotives, macro-behaviour" (Schelling, 1978),fashion. That is, stability arises mainly because we are dealing with two aggregates. To generate waves of very intense activity from a number of individual decisions, one requires a certain interdependence between these decisions; instability is potentially present if the activity of "reference groups" to individual i leads i to alter his/her behaviour from what it would have been given the values of the exogeneous variables he/she faces. Since this reference group behaviour is unlikely to occur if agents are fully informed and fully rational, what is likely to underlie instability is bounded rationality and/or excessive uncertainty on the part of the agents. Such limitations in the ability of individual agents to make reasonable decisions force them (in perhaps a procedurally rational manner; the distinction is due to Simon, 1978) to consult and respond to the decisions of other agents (within their own class) as a source of information. A series of such interdependent, mutually reinforcing expectations leading to an increasing spiral of interdependent activity within each of two classes of agents is unlikely to result in a stable correlation between the activities in aggregate of the two groups. To illustrate the argument, consider the case of instability (which is what seems consistent with previous studies; see Nelson, 1959, pp.114). In the ordinary course of affairs (i.e. periods of "low" or "normal" merger activity), firms initiate and consumate mergers according as opportunities stochastically present themselves in their normal spheres of activity. However (and quite possibly because of the activities of investors), if more and more firms begin to become more active in the market for corporate assets, then managers' reactions to the *same* flow of opportunities will change if they view the increased activity by peers and rivals as threatening, or as informative about hitherto unsuspected events, present and future. The heightened level of merger activity with an unchanged flow of opportunities is instability relative to those opportunities; if part of such opportunities are provided by economic disturbances or other investor induced events, then the correlation between the two sets of activities will be unstable. A very similar argument (which is rather more commonly encountered) about the possible interdependence of investor agents in speculative stock price booms applies to instability in the share price series, and if part of this speculative boom is fed by heightened merger activity, then this too will create instability in the correlation between mergers and share prices.

To summarize, to empirically verify that the correlation between aggregate merger activity and share prices indices is useful in the sense of a simple predictive rule, it is necessary that the correlation be stable and causal. The explanation of the possible empirical result that the correlation is stable and causal in both directions would seem to lie in significant cross-group interaction between investors and managers combined with relatively insignificant within group interaction for both groups.

III. EMPIRICAL METHOD

The basic empirical vehicle which we need to explore the prediction issue is one general enough to allow for as complex an association as is reasonable between current and past values of both variables. For this reason, we adopt a bivariate, covariance stationary times series in the variables M_t (merger activity as measured by the number of mergers [5] in period t) and S_t (the value of a stock market share price index at t), written in autoregressive form :

[5] This is the usual form that the correlation takes, although from time to time the value of mergers is used for M_t. This seems a variable particularly prone to mismeasurement; in any case, there is no reason to think that the interactive and reinforcing pattern discussed in the last section does not apply as well to the value of mergers as to the aggregate number. Where possible, we were able to explore this alternative measure of M_t and there seemed very little in it to overturn the conclusions drawn in Section V.

$$a_1^i(L)M_t + a_2^i(L)S_t = u_t^i$$

$$a_3^i(L)M_t + a_4^i(L)S_t = v_t^i$$

where : $a_j^i(L)$ is a lag polynomial, $a_j(0) = 1$ for all i; i = 1, 2 and i = 1 denotes the set of t in a period of high merger activity, T_H, and i = 2 those t in periods of low merger activity, T_L; and u_t^i and v_t^i are white noice series. This can be thought of as derived from a model in which S_t is determined by a series of exogeneous variables X_t, and M_t by a possibly overlapping set denoted Z_t. We take X_t, and Z_t to track both the opportunities open to agents and the expectations they create, and both are assumed to follow exogeneously determined autoregressive processes. Given these exogeneous determinants of S_t and M_t together with the possibility of instability (that the impact of X_t on S_t may depend on the level of S_t, and the impact of Z_t on M_t on the level of M_t) and causality (that S_t may also be driven by M_t and/or M_t by S_t), then one derives the foregoing interdependent system; it is driven in the first instance by the exogeneous autoregressive processes, and (perhaps) secondarily and certainly testably by various interactions within and between the two groups of agents.

We intend to subject this system to the two tests of interest and the principle empirical problem to be faced is not so much the tests themselves, as the sequence in which they (and various ancilliary tests) ought to be performed. After briefly describing each test taken in isolation, we shall conclude this section by looking at the sequence we propose to use.

The stability test is the fairly simple one of seeking to determine whether the a_j^i are the same in both T_H and T_L; the test we shall use in the familiar Chow Test [6]. The subsamples T_H and T_L were exogeneously chosen to reduce the demands on the data, but local experimentation showed that, in all cases, the results were not sensitive to the exact boundaries reported below. The subsamples were chosen to highlight sustained (relative to the particular sample) periods of activity, but all samples contained at least one major merger boom high by historical standards. Very similar subsamples (except for the sample covering the 1970's) occurred when the partition was done at the basis of stock market booms. In all samples, it was sufficient to partition the data into two adjacent periods (T_L followed by T_H, or conversely). Following Sims (1972, Theorem 2), our causality test is an F test on the impact of current and future values of M_t (or S_t) in a regression of S_t (or M_t) on its own past values plus past, current, and future values on M_t S_t) [7]. When the data seemed to point to no causality of S_t (or M_t) on M_t (or S_t), the slightly stronger test on the hypothesis of zero impact of all future, current, and past terms of S_t (or M_t) in the M_t (or S_t) equation was performed; failure to reject the null that : all the $a_2^i = a_3^i = 0$ confirms in a particularly emphatic manner the lack of informativeness of the one series for predicting the other.

[6] It goes without saying that this kind of test is really only persuasive on the issue that instability exists, since the simple partitioning and testing is likely to miss many interesting breaks; the test was, however, adequate in view of both our pre and post data views on stability. A caveat to the Chow Test is that the standard errors from the two subsamples must be equal (Toyoda, 1974). In all cases, we discovered unequal standard errors in either the S_t or M_t sample or usually in both. However, in all cases, F values were comfortably above 5%; at least one of the two subsamples was very large; and inspection of the actual coefficients estimated revealed appreciable differences that one would be unhappy to overlook.

[7] The alternative test involves first pre-whitening the two series and then looking at the cross correlations between the two sets of residuals; see Pierce, 1977, and the modifications and extensions proposed by Ashley et al, 1980. Such a test appears, however, biased in favour of the null of no causality; see Sims, 1977b.

It is evident that a sequence of testing must be followed as, prior to causality testing, several specification issues must be settled (e.g. to insure the appropriateness of using F-test) [8]. The procedure we followed was to order the various tests, so that the i^{th} test was conditional on the $(i-1)^{th}$ test, but not conversely; thus, decisions made at the i^{th} stage would not dictate revision of previous views. The most basic test seems to be that on the maintained hypothesis that the residuals u_t^i and v_t^i are white noise, and so the first task was to choose lag structures with an eye towards problems of dynamic specification. This was estimated freely for each equation, no attempt was made to prune out apparently insignificant coefficients, and the length was initially chosen generously. Inspection of a lengthy correlogram, tests for various orders of autocorrelation (in the spirit of Wallis, 1972), and test involving autoregressive or moving average processes of high orders using Lagrange Multiplier techniques (for an expository survey, see Breusch & Godfrey, 1981) were used to seek evidence of misspecification. As it happened, in no case did compelling evidence arise in favour of differencing, or suggesting the use of seasonal dummies; in all cases, the lag structure could be varied somewhat without upsetting the qualitative nature of the conclusions. The first step of the testing was made for the entire sample and clears the way for use of the Chow Test for stability, which was the second stage of testing. The results after this second stage could

[8] Extensive specification testing clearly consumes "real" degress of freedom, and thus weakens somewhat the persuasiveness of the causality tests. The moot point of structural stability, however, inhibits our following Ashely et al, 1980, in using post sample forecasting powers of the information set with and without putative causal variables to access causality.

be : two full period equations (one for M_t and one for S_t), or four subperiod equations, or one full period equation and two subperiod equations. In the latter two events, the subperiod equations were rechecked to verify the maintained hypothesis of white noise; as it happens, in no case was it thought necessary to readjust the lag structure of the model. The third and final stage of testing was the causality tests, applied to either full period or statistically distinct subperiod equations.

IV. FOUR SAMPLES

To pursue the correlation as prediction interpretation, we applied the foregoing tests to four different samples [9]. The samples are monthly or quarterly, for the U.S. or the U.K., differ in length, time period covered, and so on; for this reason, it is not clear that one could reasonably expect a uniformity of outcomes a priori. On the other hand, a uniformity of outcomes, if found, would seem to be strongly consistant with the isolation of some fairly fundamental patterns of behaviour.

The four samples yielded the following results :

(i) *U.K. Monthly Data : January, 1957-December, 1969* : this sample period is one of generally high activity which exloded in early 1967 to produce unprecedently high levels of merger activity for 36 months; the first 18 months of this boom saw rising levels of activity, while the second half saw falling numbers without, however, ever reaching pre-1967 levels. T_H was taken as the post-January, 1967 period and T_L was all months before then.

[9] Sample (i) is taken directly form Kuehn, 1975; samples (iii) and (iv) were taken directly from Nelson, 1959. Sample (ii) uses the total number of acquired companies (various issues of the *Business Monitor*, Table I) and the average price index of 500 shares (various issues of C.S.O. *Financial Statistics*, Table 13.8).

After some experimentation, a model with six leads and lags was found to be satisfactory for both the M_t and S_t equations. The maintained assumptions about v_t and u_t were checked by inspection of a 12 month lagged correlogram (virtually all correlations less than .06 in absolute value), and Lagrange multiplier tests against the alternatives of : first to eighth order autoregressive or moving average processes, and third, sixth and twelfth order autocorrelation. In no case could persuasive (at 5% or 1%) evidence be marshalled against the null of white noise. The Chow test suggested rejection of the null of parameter stability : $F(21,91) = 2.270$ for M_t and $F(21,91) = 3.586$ for S_t . There seemed little reason to alter the structure of the empirical model for T_H and T_L and application of the causality tests failed to reject the null of no causality ; indeed, it proved possible to exclude *all* S_t terms in the M_t equation for both T_L and T_H ($F13,87) = 1.31$; $F(16,4) = 1.599$) and *all* M_t terms in the S_t equations ($F(13,87) = 1.54$; $F(16,4) = .731$).

(ii) *U.K. Quarterly Data : I : 1969-IV : 1979* : The second sample picks up the U.K. story after the last sample for a slightly different population. The period commenced with high levels of activity, exploded eight quarters later into a frenzy lasting from I : 1971 to III : 1974 ; thereafter, activity subsideed to very low levels for the remainder of the period [10] . Pre-III : 1974 was taken as T_H, and the remainder as T_L.

Unfortunately, this sample seems to be too short to be really persuasive on *both* causality and structural stability, and we ran two

[10] The stock market rise post-1974 was not mirrored by a rise in merger activity which is a breakdown in the correlation which appears also to have occurred in the U.S.; see Steiner, 1975.

conditional exercises. Assuming no structural breaks (i.e. for the sample as a whole), then no causal patterns were detected in a model with four leads and lags (for which the usual battery of testing suggested white noise residuals); the F-statistics regarding exclusion of *all* S_t variables in the M_t equation was : $F(9,21) = 2.02$, and that for *all* M_t variables in S_t was $F(9,21) = 2.69$. The latter marginally exceeds 5% level but was not substantive enough to be strong evidence, at least in part because fairly strong evidence suggested instability : $F(6,16) = 3.511$ for M_t and $F(6,16) = 4.024$ for S_t.

(iii) *U.S. Quarterly Data : I : 1895-IV : 1920* : This is the famous Nelson (1959) data set, capturing the earliest waves of U.S. merger activity. Low levels of activity occured until the 1890's, activity rose stupendously near 1900, and then fell off into oscillating and moderate levels of activity thereafter. The two sub-samples are : I : 1898 to IV : 1903 for T_H and thereafter for T_L. This involves ignoring the first three years of the sample (part of which is lost anyway because of the lags); no difference was made when they were added to T_h (not reported in detail here).

As with the first sample, a model with six period leads and lags appeared to be a satisfactory description of the data. All estimated lagged covariances (up to 8) were less than .08 in absolute value bar one, and most were substantially so; tests against the alternatives of first, second, fourth, sixth and eighth order autocorrelation and against moving average or autoregressive processes up to order eight proved negative. The Chow tests indicated rejection of the null of parameter stability : $F(20,38) = 14.47$ for M_t and $F(20,38) = 2.583$ for S_t. The interesting feature *in this* is the unusually high level of explanation of M_t in T_H (R^2 = .95, a level achieved in virtually all S_t equations throughout) relative to T_L(R^2 = .51, fairly high itself by standards elsewhere in the other three samples). Causality tests produced the following test statistics : $F(13,37) = 1.13$ for M_t in T_L and $F(13,37) = 1.29$ for S_t in T_L ; $F(13,11) = .077$ for both M_t and S_t in T_H; as above, these applied to rejection of *all* S_t variables in the M_t equation and conversely.

(iv) *U.S. Quarterly Data : I : 1919 - IV : 1954* : The final sample traces the U.S. story through the Second War, carrying the history of U.S. merger activity into the middle 1950's. The period commenced with a boom lasting until about 1930, and finished with a gradual increase in activity which, with the benefit of hindsight, we know to herald the great 1960's merger boom. T_H is taken to be I : 1919 to IV : 1929, and the rest is T_L.

As earlier, we ultimately settled for a model with six leads and lags. All lagged (up to eight) autocovariances were less than $|.08|$ and tests (as for sample (iii)) against various alternatives to white noise all suggested no rejection of that null. The Chow test produced test statistics of : $F(21,79) = 2.929$ for the M_t equation and $F(21,79) = 4.33$ for S_t. As before, in all four cases, no evidence emerged to reject the null of no causality. F-statistics on the tests rejecting *all* S_t variables in the M_t equation were : $F(11,11) = .959$ for T_H and $F(11,68) = 1.91$ for T_L, and for rejecting *all* M_t variables in the S_t equation : $F(11,11) = .877$ for T_H and $F(11,68) = 1.436$ for T_L.

To sump up then, all four samples show surprising consistency in rejecting the null hypothesis of parameter stability and in failing to reject the null of no causality in both directions in all subperiods; not only is the null of no causality rejected for both S_t and M_t equations, but it in fact proved possible to eliminate all traces of S_t in the M_t equation and of M_t in the S_t equation. What we apparently have observed is a close association between two series with similarly timed structural breaks, but with no significantly different information in either to improve prediction of the other.

V. DISCUSSION

The correlation between aggregate merger activity and the level of stock prices has rightly been labelled : "*... an enticing byway in ... the analysis of relationships between merger activity and the business cycle*" (Scherer, 1980, pp. 126), and our results have added a little zest to the slightly exotic flavour of this curiosity. There will not be many who will seriously doubt that each of the two series is unstable, and subject to significant speculative booms based less on large changes in the exogeneous variables as on significant within-group interaction by individual decision makers. What is a little surprising is the absence of any significant cross-group activity between investors and managers. This, we have argued, must be taken to imply that the expectations and actions of each do not alter the activities of the other. However, since the expectations and actions of both move together fairly closely, our empirical result can only come about if the two sets of agents have no distinct identities or if the expectations and actions of both are driven by a third set of agents. Since in both the U.K. and the U.S., banks and capital market investors exercise only indirect (and sometimes rather remote) control over managers, it seems more reasonable to suspect that both investors and managers are guided in action and coordinated in expectation by a third party to the merger transaction, the merger promoter. This is not, it should be added, an entirely fanciful (partial) theory of merger : "... *I am enclined to place considerable weight upon one other advantage of merger : it permitted a capitalization of perspective monopoly profits and a distribution of a portion of these capitalized profits to the professional promoter. The merger enabled a Morgan or a Moore to enter a new and lucrative industry : the production of monopolies*". (Stigler, 1950, pp. 30). It would not be judicious to consider the empirical result that the correlation between aggregate merger activity and share prices is unstable and non-causal as a test of the theoretical proposition that merger promoters play an important role in coordinating the expectations and actions of investors and managers. However, this empirical result can be understood by means of that theoretical proposition and the latter is certainly worthy of further empirical research more directly aimed at assessing its validity.

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